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An Analytical Study of the Causes and Risks of Forest Fires and Ways to Combat it

Mohammed Ali Alshamali/ PhD in Civil Engineering, Department of Engineering Management and Construction, Damascus University, Syria/Correspondence:
engmohamed.lamar@gmail.com

Abstract: Forest fires are a serious environmental phenomenon and a major global threat. Their environmental, economic, and social impacts are increasing significantly, prompting further research and attention into the causes and consequences of these fires (Al Asouj, 2024). This research, based on reference studies within this context, analyzes the types, causes, and risks of forest fires, as well as the severe environmental, social, economic, and health damage they cause. It also examines methods for combating and mitigating their effects. To achieve the research objectives, a field study was conducted on forest fires in the Syrian coastal region, which is the most densely forested area in Syria and has witnessed massive fires in recent years, causing extensive damage across various sectors. The study relied on statistics and data issued by governmental and non-governmental organizations. Numerous interviews were also conducted to gather the opinions of environmental experts, researchers interested in this type of research, and members of the civil defense and firefighting teams. The study concluded that a significant proportion of fires resulted from accidents and negligence stemming from various human activities. This situation was exacerbated by the region's harsh climatic conditions, including high temperatures, drought, delayed rainfall, and wind patterns. Other contributing factors included limited resources and logistical equipment, and the absence of necessary fire control and containment policies. War remnants also played a major role in expanding the scope of fires and posed a significant obstacle to firefighting efforts. A set of recommendations and proposals were put forward for taking the necessary measures to help prevent fires, limit their spread, and minimize

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damage as much as possible should they occur, whether in the country under study or in neighboring countries or those with similar conditions to Syria.

Keywords: Forest fires, Vegetation, Fire Risk, Types of Forest Fires, Environmental Impact of Fires, Syrian Coast.

دراسة تحليلية لأسباب ومخاطر حرائق الغابات وسبل مكافحتها

د.م.محمد علي الشمالي

دكتوراه في الهندسة المدنية، قسم الإدارة الهندسية والتشييد، جامعة دمشق، سوريا، للتواصل:
engmohamed.lamar@gmail.com

ملخص:

تُعد حرائق الغابات ظاهرة بيئية خطيرة وتهديدًا عالميًا كبيرًا، تتزايد آثارها البيئية والاقتصادية والاجتماعية بشكل ملحوظ، مما يدفع إلى مزيد من البحث والاهتمام بأسباب هذه الحرائق وعواقبها (Al Asouj, 2024). يحلل هذا البحث بالاستناد إلى دراسات مرجعية ضمن هذا السياق أنواع وأسباب ومخاطر حرائق الغابات والأضرار البيئية والاجتماعية والاقتصادية والصحيّة الجسيمة التي تنجم عنها، وكذلك سبل مكافحتها والتخفيف من آثارها، ولتحقيق أهداف البحث تم إعداد دراسة ميدانية حول حرائق الغابات في منطقة الساحل السوري حيث تُعدّ المنطقة الساحلية أكثر المناطق كثافةً حرجيةً في سوريا، وفي السنوات الأخيرة شهدت حرائق هائلة تسببت بأضرار جسيمة في مختلف الجوانب. وقد تم الاعتماد في الدراسة على بعض الإحصائيات والبيانات الصادرة عن المنظمات الحكومية وغير الحكومية، كما أُجريت العديد من المقابلات لجمع آراء خبراء البيئة والباحثين المهتمين بهذا النوع من الأبحاث، وأفراد الدفاع المدني وفرق الإطفاء. وخلصت الدراسة إلى أن نسبةً كبيرةً من الحرائق نجمت عن حوادث وإهمال ناجم عن أنشطة بشرية مُختلفة، وقد تفاقم هذا الوضع بفعل الظروف المناخية القاسية في المنطقة، بما في ذلك ارتفاع درجات الحرارة والجفاف وتأخر هطول الأمطار وأنماط الرياح، وشملت العوامل المساهمة الأخرى محدودية الموارد والمعدات اللوجستية، وغياب السياسات اللازمة لمكافحة الحرائق واحتوائها، وقد لعبت مخلّفات الحرب دوراً كبيراً في توسيع نطاق الحرائق وتشكيل عقبة رئيسية أمام جهود إخمادها. وقد تم اقتراح مجموعة من التوصيات

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والمقترحات لاتخاذ التدابير اللازمة التي من شأنها المساعدة في منع ظاهرة الحرائق والحد من انتشارها وتقليل الأضرار قدر الإمكان في حال وقوعها سواء في بلد الدراسة أو ضمن البلدان المحيطة أو التي تتشابه ظروفها مع الظروف السورية.

الكلمات المفتاحية: حرائق الغابات، الغطاء النباتي، مخاطر الحرائق، أنواع حرائق الغابات، الأثر البيئي للحرائق، الساحل السوري.

1. Introduction:

Forests represent a major natural resource and provide numerous environmental, economic, and social benefits, including the preservation of biodiversity and genetics, contributions to the nutrient cycle, soil erosion mitigation, air purification, climate regulation, and the provision of food, fiber, and fuel (Mohamed,2021).

Forest fires are a serious environmental phenomenon and a significant global threat. Their environmental, economic, and social impacts are increasing noticeably, prompting further research and attention into the causes of these fires and their consequences (Al Asouj, 2024). Several causes have been identified, including deliberate or intentional fires resulting from environmental activities, and natural causes such as rising temperatures, drought, and other factors.

The forests of the Syrian coast are considered the lungs of Syria due to their significant environmental impact. These forests are characterized by their lush greenery, density, vast extent, and ecological and biological diversity. They are Mediterranean forests,

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whose distribution is often linked to climate and topography, and contain a variety of trees of different ages, such as pine, oak, juniper, willow, and others.

Despite the importance of these forests and their diverse environmental and economic benefits, they have witnessed massive fires in recent years, turning vast areas to ash and causing extensive damage to homes, commercial and industrial facilities (Fig.1). Some reports indicate that Syria lost 3,505 hectares of forest in 2020, a 159% increase compared to 2019, meaning that nearly 20% of Syria's forests have been lost since 2000. The hotspots of these fires are located along the Mediterranean coast near Latakia and Tartus, home to more than three-quarters of the country's forested areas (Mohamed,2021).

Fig.1 A collection of images illustrating forest fires on the Syrian coast

This research will review the types of forest fires, their risks and damages, and identify the reasons behind the increase and spread of fires in the forests of the Syrian coast. It

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will also offer recommendations and proposals that can help combat these fires, mitigate their damage, and prevent their spread.

2. Research problem

Given the significant risks and severe damage caused by fires across various environmental, economic, social, and health sectors, and their direct and indirect impact on humans, this topic has garnered the attention of numerous researchers interested in this type of research. This necessitates that we point out the danger of these fires, their types, causes, and the damage that may result from them, in order to develop appropriate solutions to avoid them, limit their spread, and develop strategies and mechanisms to combat them.

The Syrian coastal regions are among the richest areas in Syria in terms of forest cover and biodiversity, forming the country's ecological lung. However, forest cover has been gradually decreasing in recent years due to the frequent occurrence of fires of varying intensity, from moderate to severe. These fires have consumed thousands of hectares of forest and agricultural land, and destroyed numerous homes, industrial, commercial, and tourist facilities. Consequently, they have had a significant impact on various environmental, economic, social, and health aspects. This research will highlight the risks and types of forest fires, and offer recommendations for preventing, mitigating, and minimizing their damage should they occur

3. Importance and Objectives of the Research

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The importance of this research lies in highlighting the types of fires, their causes, and the serious risks they pose to various economic, environmental, social, and health aspects, thereby raising public awareness of the dangers of these fires.

A field study was conducted on the forest fires that have occurred and are still occurring in the Syrian coastal regions and other areas of Syria, in order to develop mechanisms and plans that help combat the phenomenon of fires, reduce their damage, and limit their spread.

The author expects this research to form a basis for analyzing and studying fires and their risks, so that its findings can be generalized to many neighboring countries or those with similar conditions to those in Syria.

4. Reference studies:

In his study (An Assessment of Forest Cover Change and Its Driving Forces in the Syrian Coastal Region during a Period of Conflict, 2010 to 2020), researcher Mohamed monitored and analyzed changes in forest cover dynamics and density between 2010 and 2020 using multi-time Landsat imagery. This study also analyzed the relationship between changes in forest cover and selected physical, social, and demographic variables associated with the drivers of change. The results revealed that the study area experienced a significant decrease in total forest area (31,116.0 hectares, or 24.3%), accompanied by a substantial decrease in density, with dense forest area declining by 11,778.0 hectares (9.2%) between 2010 and 2020. The change in forest cover was driven by a variety of conflict-related factors. The main drivers were changes in economic and social activities, intensive exploitation of forest resources, frequent forest fires, and weak state institutions in natural resource management and environmental development.

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Forest loss was also linked to the expansion of cultivated land and the increase in population and urbanization. Fluctuating climatic conditions are not a primary driver of forest cover dynamics in the study area. The decline in forest area and density reflects sharp shifts in the natural environment during the study period. In the foreseeable future, it is not possible to determine whether changes in forest cover and density will be permanent or temporary. Monitoring changes in forest cover and understanding their drivers provides quantitative and qualitative information for improved planning and decision-making. The findings of this study have prompted decision-makers to take immediate action and identify initial intervention areas to protect existing forests on the Syrian coast from loss and degradation, as well as to develop policies for the long-term sustainable management of forest resources (Mohamed,2021).

In their study, "Evaluation of Forest Fire Damage and Risk in Northern Latakia During the Crisis Years Using the Normalized Burn Ratio," researcher **Merhej** and her colleagues calculated the Normalized Burn Ratio (NDR) values for the studied period to determine the health of the vegetation cover in the studied locations. Based on these NDR values, the Natural Burn Ratio (dNBR) was calculated to identify burned areas and estimate the level of fire risk. The results of this study showed a significant decrease in the 2006 NBR values at the Al-Basit site, while a similar decrease was observed in 2014 at the Al-Haffah site. The spatial distribution of the fires showed that they spread over large and continuous areas at the Al-Basit site, while the fires at the Al-Haffah site were sporadic but more intense. The study concluded that it is important to use the National Forest Fire Ratio (NBR), derived from remote sensing data, to assess forest fire risks, map fire boundaries, and monitor recovery and rehabilitation phases.(**Merhej et al. 2019**)

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The study conducted by researcher Ali, entitled (An Analytical Study of Forest Fires in Lattakia and Al-Ghab (Syria)), concluded that despite the increasing number of fires over time in both Latakia and Al-Ghab, the total area burned per 10,000 hectares decreased from 47.03 hectares/year during the period 1987-1998 to 6.64 hectares/year during the period 1999-2002 in Latakia, and from 11.85 hectares/year during the period 1982-1998 to 8.71 hectares/year during the period 1999-2002 in Al-Ghab. While these results reflected a decline in the effectiveness of fire prevention measures in both Latakia and Al-Ghab, they also demonstrated a significant improvement, particularly in Latakia, in fire suppression procedures (Ali, 2004).

A study by Gajendiran and her colleagues titled (Influences of wildfire on the forest ecosystem and climate change: A comprehensive study) demonstrated that wildfires have complex impacts on forests, including changes in vegetation cover, threats to biodiversity, and greenhouse gas emissions such as carbon dioxide, thus exacerbating climate change. The impact of wildfires on animal habitats is particularly noteworthy, as they can lead to significant changes in native environments. The extent of these changes in species and habitats plays a crucial role in shaping the forest ecosystem. Drought, disease, insect infestations, overgrazing, or their combined effects can amplify the negative impacts on specific plant genera and entire ecosystems. In addition to the immediate consequences of plant death and altered community dynamics, wildfires have far-reaching effects. They often increase flowering and seed production, further impacting ecological communities. However, one worrying trend is the decline in forest biodiversity within fire-affected areas. In addition to their environmental impacts, wildfires release large quantities of greenhouse gases and particulate matter into the atmosphere, leading to dramatic changes in climate patterns and contributing to global

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warming. As vegetation burns during these fires, it releases the carbon it contains, making large wildfires detrimental to biodiversity and a major contributor to carbon dioxide emissions, a significant greenhouse gas. Measuring the global impact of wildfires on ecosystems and greenhouse gas emissions has become critically important. This research sheds light on the complex relationships and feedback loops that link wildfires, ecosystem clusters, and the evolution of the climate landscape **(Gajendiran et al.2024)**.

The review titled (Impact of Forest Fire on Forest Ecosystem) by researcher Arshad and colleagues provides a summary of the impact of forest fires on the forest ecosystem, including their effects on vegetation, soil, water, and air relations. This review was discussed in detail, with fires being prioritized as a primary cause. Fires can significantly alter the composition, density, and diversity of vegetation cover by promoting fire-adapted species, change soil properties through the addition of ash and altered nutrient levels, and alter water quality through the introduction of chemicals. The effects of fires depend on the fire regime, climate, and vegetation type (Arshad et al.2022).

The study conducted by Ola, titled (Factors contributing to forest fires and their effects - Asir region as a case study), recommended refraining from burning dry grass and shrubs in piles, avoiding lighting fires while camping in green spaces or before sleeping, and refraining from starting fires in unregulated waste dumps in forested areas. It also advised: extinguishing fires completely, cooperating with the community, and encouraging citizens to participate in fire prevention and response measures. When a fire occurs, it must be extinguished immediately to minimize damage and losses. Raising community awareness and increasing awareness among families is also

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recommended. The value and importance of trees should be appreciated, and burning dry grass and shrubs in piles should be avoided. Furthermore, more research and studies on forest fires should be conducted to explore aspects beyond those previously investigated, in order to gain a comprehensive understanding of all relevant aspects of the study (Al Asouj, 2024).

According to Ewald and colleagues, rising temperatures and the anticipated increase in the frequency of droughts and heat waves have raised concerns about wildfires in cool, humid temperate continental regions. This concern is compounded by a lack of detailed knowledge about fire behavior and fire ecology in many of these areas. A special issue titled "Wildfires in Cool, Humid Temperate Continental Forests" was published in early 2022 in the journal Forestry to compile studies addressing these current knowledge gaps. Featured papers by Ewald and colleagues cover a range of topics, including remote fuel assessment, field evaluation, forest fuel flammability, fire behavior, and fire impacts. This article provides an overview of these papers and their key findings. Based on the results of the special issue and a review of recent literature, we have identified key directions for future research addressing fire behavior, fuel properties, and post-fire forest management (Ewald et al.2025).

A research paper by Kumar and colleagues, titled (Forest Fires in India and their Mitigation Measures), confirms that increasing population growth, urbanization, and several other factors, including the frequency of forest fires, pose a serious threat to forests, which act as ecosystem balancers. Forest fires have increased significantly in India, without exception, impacting biodiversity, wildlife, and other natural resources. Burning vegetation releases enormous quantities of carbon, greenhouse gases, and other

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gaseous compounds into the atmosphere, contributing to global warming and climate change. Human activities such as forest cultivation, deforestation, and firewood burning are the main causes of forest fires in India. Therefore, forest fire monitoring and management are crucial for countries like India. To effectively monitor and manage forest fires in India, it is essential to have knowledge of forest types, vegetation patterns, and the causes of forest fires. Consequently, government agencies have reviewed forest fire conditions in India, adopted various mitigation measures, and implemented different initiatives and policies for forest fire detection and control. Satellite sensing and geographic information systems (GIS) have been developed to image the extent and duration of forest fires in real time. Joint Forest Management Committees (JFMs) also work with local communities to control forest fires in villages, offering them rewarding incentives for their valuable work. This paper addresses the challenges and mitigation strategies that can help manage forest fires effectively.(Kumar et al.2025)

Forest fires play a dual role in ecosystems, fostering biodiversity while posing significant threats when their frequency and intensity increase (**Shivaprasad et al.,2025**). Immediate impacts include habitat destruction, species loss, and air pollution, while long-term effects alter community dynamics and ecological processes. Fires also induce indirect consequences, such as changes in nutrient cycling, soil structure, and water availability, promoting regeneration in fire-adapted species and enhancing ecosystem resilience. However, the rising frequency of wildfires, driven by climate change, significantly threatens global forest biodiversity. Effective fire management and sustainable practices are essential to mitigating these impacts. Postfire management, including reforestation and habitat restoration, is crucial for ecosystem recovery. Integrated fire management must balance risk reduction with biodiversity conservation,

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acknowledging both the destructive and regenerative roles of fire. Further research is vital to understand the complex relationship between forest fires and biodiversity, promoting adaptive strategies for managing fire-prone ecosystems in a changing climate **(Shivaprasad et al.,2025)**.

To estimate the impact of wildfires on GDP growth and employment in Southern European regional economies between 2011 and 2018, researcher Meier and colleagues, in their study titled (The regional economic impact of wildfires: Evidence from Southern Europe), matched Eurostat economic data with the geographical perimeters of burned areas, based on satellite imagery, for 233 NUTS (National Units of Statistics) Level III regions in Portugal, Spain, Italy, and Greece. The estimation of mechanistic variables with fixed effects indicated a contemporary average decrease in the region's annual GDP growth rate of between 0.11% and 0.18%, provided the region experienced at least one wildfire. This translates, in an average wildfire season, to an annual loss of output of between €13 billion and €21 billion in Southern Europe. The impact on the rate of employment growth is heterogeneous across types of economic activity, with a decrease in the average annual rate of employment growth for retail and tourism-related activities (e.g., transportation, accommodation and food service activities) of 0.09-0.15%, offset by employment growth in insurance, real estate, administration and support services activities of 0.13-0.22% **(Meier et al.,2023)**

Forest fires are among the most prevalent disturbances affecting forests, significantly impacting the environment and the socio-economic conditions of countries worldwide. To prioritize national efforts to combat forest fires and mitigate their negative effects, researcher Kala conducted a literature review examining the various environmental,

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social, and economic impacts of forest fires. The G20 countries were selected for this study because they collectively represent 60% of the world's population, contribute approximately 80% of global GDP, and serve as a strategic multilateral platform connecting major developed and emerging economies. This review demonstrates that while the G20 countries contribute significantly to the world's forests (69.26%), they are also negatively impacted by forest fires, which adversely affect the environment and the diverse forest species they possess. To mitigate the environmental and socio-economic impacts of forest fires, countries should initiate and strengthen bilateral and multilateral cooperation and coordination, sharing adequate financial resources, technologies, and training (Kala,2023).

The fire causes mass property damage, physical harm, or death to the people unfortunate enough to be caught in the blaze; second, the health hazards of smoke inhalation and the emotional strain of losing one's possessions cause immense physical and emotional harm to the fire's victims. Another health hazard that is becoming more common due to global warming is heatwave exposure. The heat provides an ideal environment for certain pathogens to thrive, increases people's risk of developing temperature-related health conditions, and could exacerbate many preexisting diseases. The increase in frequency and intensity of these extreme weather conditions calls for devotion of resources to fire prevention and public health measures related to smoke inhalation and heat exposure (**Rossiello and Szema,2019**)

5. Research Methodology and Steps:

The descriptive-analytical method was used in this research to achieve the specified objectives, and Figure (2) below illustrates the research steps.

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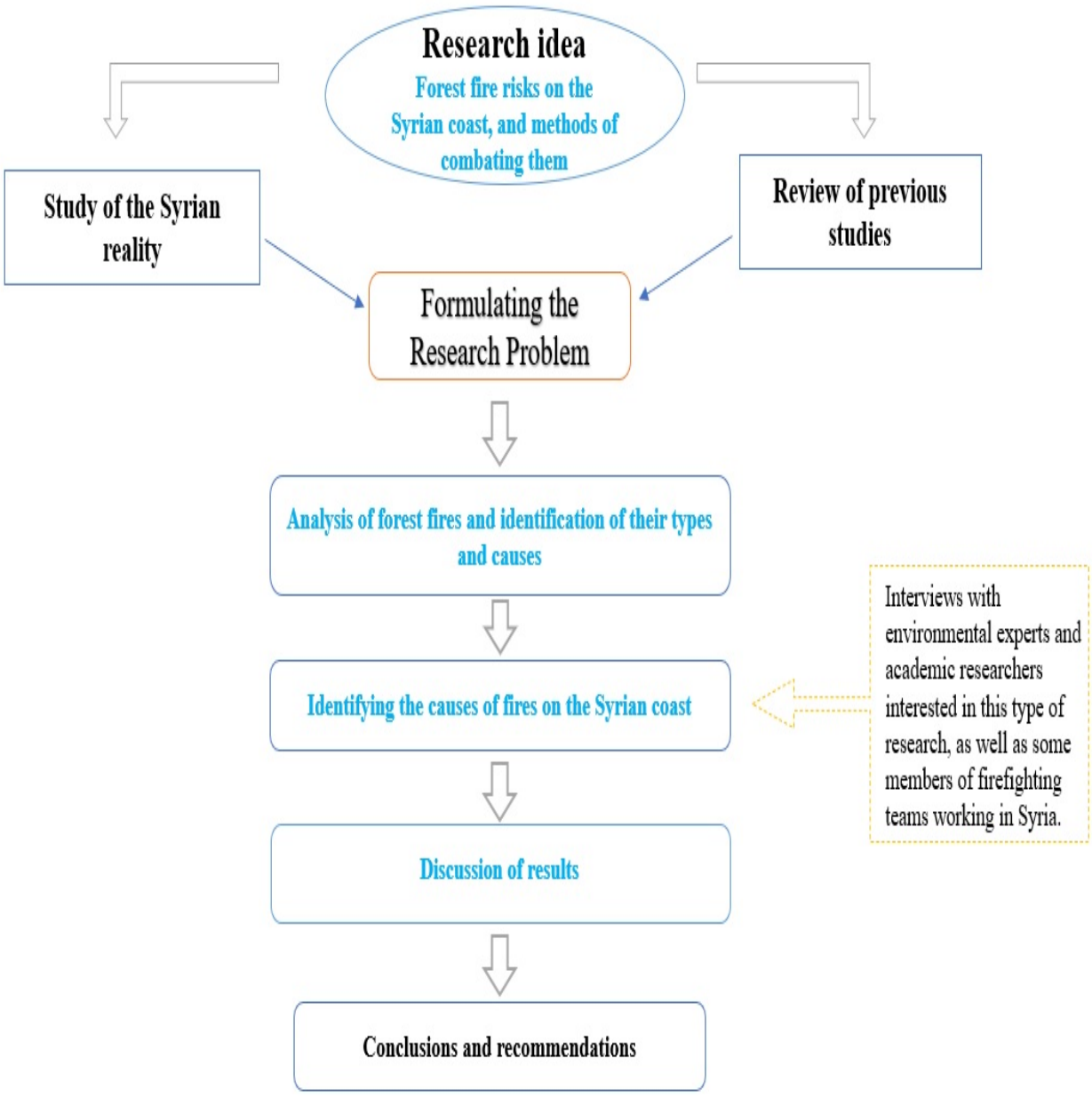

Fig.2 Research Steps

6. Reasons and types of forest fires

Due to the extreme importance and enormous risks associated with forest fires, this topic has attracted the attention of many researchers interested in this type of research (Al

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Asouj,2024)(Ewald et al.2025)(Kumar et al.2025)(Ali, 2004)(Merhej et al. 2019)(Shivaprasad et al,.2025). By reviewing numerous scientific papers and studies within this context, the causes of forest fires can be summarized into a set of categories, each category including a set of causes, as shown in the following table(1).

Table.1 Reasons and types of forest fires the table was prepared by research

Seq.	Category	Reasons	Description
1	natural fires	High temperatures	This leads to drying out the plants and making them more flammable.
2		Drought	Dry vegetation, such as grass and fallen leaves, increases the risk of fire starting and spreading.
3		Wind speed	The wind helps to feed the fire with oxygen and carry embers over long distances, causing the fire to spread rapidly.
4		Lightning	Lightning is considered one of the most important natural causes of forest fires, especially when it strikes dry areas with dry vegetation cover.
5		Plant type	Some types of plants and trees contain flammable oils that contribute to an increased risk of fires.
6		Accumulation of leaves and debris	Accumulation of leaves increases the risk of fires by increasing the amount of flammable fuel
7		Solar radiation	Solar radiation contributes to fueling them by increasing temperature and providing energy for the fires.
8	Deliberate fires (human activities)	Arson or vandalism	Fires are deliberately set for various reasons, including vandalism or acts of revenge.
9		Smoking	Throwing cigarette butts in dry places near forests

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10		Expanding agricultural areas	Areas of forest may be burned to expand agricultural land.
11		Tourism and camping	Lighting fires in forest campsites and neglecting to properly monitor and extinguish them.
12	Accidental fires	Use of fireworks	The use of fireworks in areas near forests can lead to various fires.
13		Power transmission lines	Electrical sparks caused by faults in power lines or accidents involving oil pipelines and other infrastructure.
14		Machinery and equipment	Sparks from electrical equipment or generator malfunctions.

Based on the area of the fire, forest fires are divided into three groups: ground fires, surface fires, and crown fires (Kumar et al.2025). The following table (2) shows a comparison between the three types.

Table.2 Comparison between types of forest fires (ground - surface - crown) **the table was prepared by research**

Comparison criteria	**Ground fires (It doesn't happen in Syria)**	**Surface fires**	**Crown fires**
Fire location	It burns underground and consumes deep organic materials such as peat and coal, and can also include tree roots.	It ignites in ground cover such as grasses, dead organic matter, and fallen leaves.	It burns in the canopies of trees from top to bottom, including leaves, branches, and twigs.
Intensity	They can last for decades and are difficult to extinguish because they spread slowly underground.	mild to moderate	One of the most dangerous and severe types of fires
Damage	It causes significant damage to trees and roots, takes a long time to spread, and is	They cause less damage compared to coronal fires and leave greater chances for some parts of the	It leads to widespread destruction in the forest, causes the death of trees, and can be fatal to

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	often associated with severe drought.	forest to survive, especially in fire-resistant trees such as pines.	firefighters and local residents due to its high rate of spread.
Method of Spread	It spreads slowly beneath the Earth's surface.	It can turn into crown fires if the fire reaches the base of the lower branches of trees or if large amounts of woody debris accumulate.	It spreads very rapidly through the forest canopy and is strongly affected by wind and tree density.

7. Risks resulting from forest fires:

The damage and risks resulting from forest fires are varied, encompassing numerous economic, environmental, and social aspects.

7.1. Economic Risks

Fires can destroy homes and businesses, require enormous costs to repair infrastructure such as power lines and roads, and lead to loss of life and displacement, negatively impacting families and communities. Forest destruction affects industries such as timber, disrupting supply chains and impacting local economies. Closure of affected areas can lead to lost tourism and entertainment revenue. In addition, huge sums are spent on firefighting, preparedness, and relief efforts. The economic downturn caused by fires can lead to a decrease in GDP growth in affected areas as property values in fire-prone regions decline, even after the fire has ended (**Meier et al.,2023**).

7.2. Environmental Risks

Fires destroy vast areas of forests, leading to the extinction of some animal and plant species, the destruction of their natural habitats, and the loss of their food sources(Arshad et al.2022). Fires also release large quantities of pollutants, such as carbon dioxide, which contributes to global warming and air pollution, negatively

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impacting respiratory health (**Gajendiran et al.2024**). Furthermore, fires destroy organic matter in the soil and alter its physical and chemical properties, such as pH and porosity, reducing its water absorption capacity and leading to erosion. Fires can also contaminate water sources like rivers and lakes due to surface runoff carrying ash and sediment, affecting drinking water quality and aquatic life. Ecosystems may take decades or even millennia to recover from severe fires, as their ability to restore biodiversity and natural soil properties is severely impacted. (White Helmets Report[1],2025).

7.3. social Risks

Fires force residents to evacuate, destroying homes, cutting off livelihoods, and displacing families. Survivors suffer immediate and ongoing psychological trauma, which can lead to depression, post-traumatic stress disorder, and anxiety, particularly among children and adolescents (Kala,2023). Environmental degradation can also lead to a sense of loss of nature, impacting overall well-being. Fires destroy homes, businesses, and vital infrastructure, causing significant losses and leaving communities in dire need of rebuilding and repair. Communities suffer substantial economic losses due to job losses, reduced GDP, and decreased property values. Economic sectors reliant on tourism and outdoor activities are negatively affected, especially since the closure of affected areas limits tourism and leisure opportunities. Marginalized communities often lack sufficient resources for evacuation, reconstruction, and recovery, exacerbating

[1] The White Helmets are a volunteer civil defense organization operating in Syria. Founded in 2013, they consist of 3,000 Syrian civilian volunteers and aim to provide relief to those affected by conflict. Operating in accordance with international humanitarian law, as defined in Protocol I, article 61 of the 1949 Geneva Conventions, they strive to provide a range of services to the Syrian people. These services include warning civilians of attacks and dangers, conducting search and rescue in urban areas, evacuating civilians from areas nearing conflict, providing medical services such as first aid, firefighting, managing emergency shelters, providing emergency housing and supplies, and offering emergency burials, among other services.

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existing inequalities and making it even more difficult for them to cope with the disaster's aftermath (Kala,2023).

7.4. Health Risks

Wildfires exacerbate conditions such as asthma, chronic obstructive pulmonary disease (COPD), and bronchitis, especially in children and the elderly. The tiny particles and gases in the smoke can increase the risk of respiratory infections like pneumonia. Symptoms may include coughing, runny nose, and inflammation in the lungs. Smoke exposure increases the risk of heart attacks and strokes, even in people without pre-existing lung conditions. Short-term smoke exposure can lead to increased arterial stiffness and heart rate. The stress of displacement, property loss, and continued exposure to wildfire smoke can lead to increased rates of depression and anxiety. Post-traumatic stress disorder (PTSD) can occur and may last for years. Smoke exposure during pregnancy can lead to low birth weight, an increased risk of birth defects, childhood diabetes, and even death. Damaged buildings and property may present additional hazards such as falling sharp objects, damaged electrical wiring, and gas leaks (**Rossiello and Szema,2019**).

8. Forest fires on the Syrian coast:

The forests in the Syrian coastal region are Mediterranean forests, and their spread is often linked to climate and topography [5][6]. These forests contain trees of different ages and sizes, the most important of which are broad-leaved trees such as (Quercus) of various species, and conifers such as (Pinus halepensis) and (Pistacia palaestina), which cover 57%, 29% and 9% of the forest area respectively, in addition to (Juniperus excelsa), (Abies Cilicia) and (Cedrus libani) trees that form high forests in the

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region[5][6].

A report by the Conflict and Environment Observatory (CEOBS[2]) revealed that Syria lost 3,505 hectares of forest in 2020, an increase of 159% over 2019, meaning that nearly 20% of Syria's forests have been lost since 2000. The fire hotspots are along the Mediterranean coast near Latakia and Tartus, home to more than three-quarters of the country's forested areas. The report confirmed that between 2010 and 2020, nearly a quarter of coastal forests were lost, amidst a significant decline in forest density. Conversely, there was an increase in agricultural and desert areas. The rate of forest loss has accelerated in recent years due to urban sprawl and a 20% increase in fire activity. (Mohamed,2021).

The number of fires that occurred on the Syrian coast reached approximately 9,600 from the beginning of 2025 until the end of September. The Syrian Ministry of Agriculture and Agrarian Reform recorded damage to more than 14,000 hectares as a result of the fires that broke out on the Syrian coast in 2025. It explained that forests and woodlands recorded the largest percentage of damage, with an area of 11,675 hectares, which is equivalent to 82.55% of the total burned areas. Agricultural lands came in second place, with an area of 2,152 hectares, or 15.21%. The damage to urban lands amounted to 193.78 hectares, equivalent to 1.37% of the total burned area. The damage also included 53 hectares of water bodies, equivalent to 0.37%, and 67.94 hectares of mixed-use lands were damaged, representing 0.48%. The percentage of barren, neglected, and transformed lands amounted to 1.93 hectares, equivalent to 0.01% of the burned area.

[2] **Conflict and Environment Observatory** CEOBS was launched in 2018 with the primary goal of increasing awareness and understanding of the environmental and derived humanitarian consequences of conflicts and military activities. In this, we seek to challenge the idea of the environment as a 'silent victim of armed conflict'

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(Syrian Ministry of Agriculture and Agrarian Reform website http://www.moaar.gov.sy/).

By interviewing some civil defense personnel working on the ground in the field of firefighting, as well as by reviewing some official and unofficial reports (White Helmets Report, 2025), the most important obstacles that led to the difficulty of firefighting and civil defense teams dealing with fires and controlling them quickly can be identified as follows:

1. Strong, dry easterly winds and constant shifts in direction accelerate the spread of fires in all directions.

2. Extremely rugged terrain.

3. Lack of nearby water sources (distances can reach 20 to 30 kilometers).

4. Absence of firebreaks and access roads to the fire hotspots.

5. Severe drought affecting vegetation and trees (Syria is experiencing its worst drought in 60 years).

6. The presence of landmines and unexploded ordnance, which threatens the safety of firefighting teams and hinders their access to the fire hotspots.

The main reasons that led to the occurrence of fires in the forests of the Syrian coast can be summarized as shown in the following figure (3).

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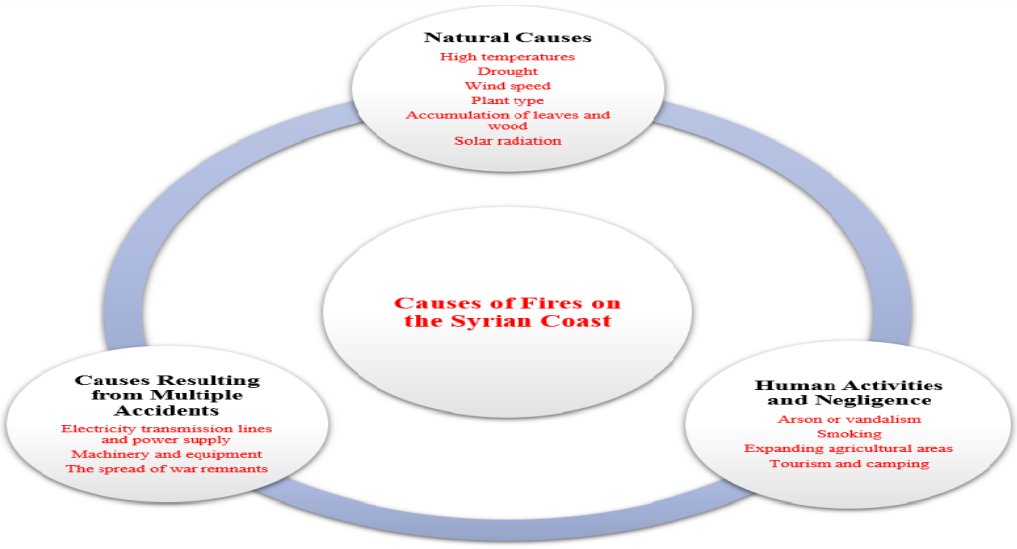

Fig. 3 shows the main causes of fires in the forests of the Syrian coast

After identifying a sample of fires, numbering (600) fires distributed across the entire Syrian coast, and through the preparation of a suitable statistical model based on the opinions of /45/ experts in the field of environment and forest fires, and those working in this context within Syria and researchers interested in this type of research, and based on official reports issued by the Ministry of Agriculture and Agrarian Reform, and some reports from non-governmental organizations, the percentage of causes of the emergence of the fire was determined as shown in the following table (3).

Table.3 Percentage of causes of fire on the Syrian coast the table was prepared by research

Seq.	Cause of the fire	Type of fire	Percentage%
1	High temperatures	Natural	10
2	Drought	Natural	10
3	Wind speed	Natural	8

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4	Plant type	Natural	2
5	Accumulation of leaves and wood	Natural	5
6	Solar radiation	Natural	1
7	Arson or vandalism	Human Activities and Negligence	10
8	Smoking	Human Activities and Negligence	12
9	Expanding agricultural areas	Human Activities and Negligence	15
10	Tourism and camping	Human Activities and Negligence	1
11	Electricity transmission lines and power supply	Causes Resulting from Multiple Accidents	9
12	Machinery and equipment	Causes Resulting from Multiple Accidents	3
13	The spread of war remnants	Causes Resulting from Multiple Accidents	14

9. Conclusions

This research paper contributed to the study and analysis of forest fires, identifying their causes, major risks, and resulting damages. As a field study to achieve the research objective and clarify the importance of addressing forest fires, the focus was on fires in the Syrian coastal region as a case study. It was found that most fires were caused by natural conditions such as high temperatures and drought during the peak of summer, and high wind speeds, which contributed significantly to their expansion and spread. The paper emphasized the role of human activities in starting fires, as some were deliberate, motivated by sabotage and revenge. In addition, some farmers tried to

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expand agricultural lands at the expense of forest lands through deliberate burning. Negligence also played a major role in starting fires, such as throwing lit cigarette butts randomly and other reasons. War remnants also contributed to the increased spread of fires, as unexploded ordnance and accumulated flammable materials easily ignite fires. The presence of war remnants also hinders the work of firefighting teams, which increases the difficulty of controlling fires and their spread, especially in areas that were previously military confrontation zones. The study showed that these fires have significant negative effects, including economic effects as a result of turning large areas of forests into ash, and damaging many homes and nearby agricultural and industrial facilities. They also have health effects, as they caused many injuries from various burns to residents and firefighters, in addition to respiratory problems caused by smoke, and psychological problems and fear among residents when they see the fires. They also caused serious damage to the environment and biodiversity immediately, as they destroyed important and rare types of trees and plants, destroyed the habitats of wild animals, and killed many of them, and forced large numbers to move to safe environments. They also have future environmental effects, especially with regard to soil and water pollution and climate change.

10.Recommendations

To mitigate the environmental, social, economic, and health damage caused by forest fires, and to prevent their recurrence, a set of preventative measures must be taken to stop fires from starting and limiting their spread (*Whether within the country under*

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study Syria or in neighboring countries and countries whose conditions are similar to Syrian conditions):

- Enacting laws and legislation that criminalize the deliberate burning of forests or acts of vandalism, ensuring strict and deterrent accountability.
- Implementing initiatives and activities to educate the community and raise public awareness about the dangers of forest fires and to discourage negligence, such as discarding cigarette butts in forested areas or failing to properly extinguish camping fires. This includes curbing the practice of burning to expand agricultural land at the expense of forest land, and promoting the use of traditional and advanced controlled burning methods to achieve sustainable agriculture and the management of plant and animal life.
- Government oversight and the implementation of necessary measures to detect and remove war remnants, given their significant impact on increasing the spread of fires and the considerable danger they pose to firefighters and residents. International expertise in this field can be utilized, drawing on the experiences of countries that have experienced war.
- Establish a mechanism for the regular cleaning of forests, removing fallen leaves and dry, deciduous tree branches, as these contribute to rapid ignition and spread of fires.
- Enhance firefighting and public safety capabilities by increasing the number of fire stations and volunteers, especially in forested areas, and by involving local communities in firefighting and fire prevention efforts.

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- Improving forest management by creating firebreaks or fire lines – if there is no natural fire barrier – to divide forests into sections, thus containing fires within a single area and limiting their spread to other parts, thereby facilitating firefighting efforts.
- Maintain existing roads leading to forests and construct new ones to enable civil defense teams and volunteers to reach all areas of the forest in the event of a fire.
- Preparing and implementing national and community afforestation campaigns targeting areas affected by fires on the Syrian coast, such as Latakia, Tartous and Jableh, in partnership with official bodies, organizations and volunteer teams with the aim of restoring degraded vegetation cover, restoring ecosystems, reducing the effects of climate change and promoting environmental awareness.

11.References:

[1] Al Asouj, A O.(2024). Factors contributing to forest fires and their effects - Asir region as a case study. Arab Journal for Scientific Publishing. Volume: 7, Issue: 66 https://doi.org/10.36571/ajsp664

[2] Ali, M.(2004).An Analytical Study of Forest Fires in Lattakia and Al-Ghab (Syria). Tishreen University, Journal for Studies and Scientific Research- Agriculture Science Series Vol (26) No (1). https://journal.latakia-univ.edu.sy/index.php/bioscnc/article/view/8244/7979

[3] Arshad, A. Ashraf, A. Ks, A.(2022). Impact of Forest Fire on Forest Ecosystem. J. Agric. Technol., 9(1 & 2): 18-29. https://www.researchgate.net/publication/364756981

[4] Ewald, M . Conedera, M . Stavros, N E .(2025). Fabian Ewald Fassnacht, Forest fires in cool-temperate and humid-continental forests—an overview, Forestry: An International Journal of Forest Research, Volume 98, Issue 1, January 2025, Pages 1–5, https://doi.org/10.1093/forestry/cpae063

[5] Forest Conditions in Syria and Lebanon. Available online: http://www.fao.org/3/x5343e/x5343e06.htm (accessed on 26 October 2020).

[6] Forests in Syria. Available online: http://www.forest-monitor.com/en/forests-syria/ (accessed on 26 October 2020).

Multi-knowledge Electronic Comprehensive Journal For
Education And Science Publications (MECSJ)
Issue No. 90 - December 2025
ISSN: 2616-9185

[7] Gajendiran, K. Kandasamy, S. Narayanan M.(2024). Influences of wildfire on the forest ecosystem and climate change: A comprehensive study. Environmental Research Volume 240, Part 2, 1 January 2024, 117537. https://doi.org/10.1016/j.envres.2023.117537

[8] Kala, C.P. Environmental and Socioeconomic Impacts of Forest Fires: A Call for Multilateral Cooperation and Management Interventions. *Nat. Hazards Res.* 2023, *3*, 286–294. [Google Scholar] [CrossRef] .

[9] Kumar, S N . Biswal, S K . Kumar S .(2025). Forest Fires in India and their Mitigation Measures. BIONATURE, Volume 45, Issue 2, Page 85-94. DOI: https://doi.org/10.56557/bn/2025/v45i22070

[10] Mohamed, M. A. (2021). An Assessment of Forest Cover Change and Its Driving Forces in the Syrian Coastal Region during a Period of Conflict, 2010 to 2020. *Land*, *10*(2), 191. https://doi.org/10.3390/land10020191

[11] Meier , S. Elliott, R. Strobl, E.(2023). The regional economic impact of wildfires: Evidence from Southern Europe. Journal of Environmental Economics and Management, Volume 118, March 2023, 102787. https://doi.org/10.1016/j.jeem.2023.102787

[12] Merhej, O. Ali, M. Thabeet, A. Idress, y. (2019) . Evaluation of forest fire damage and risk in northern Latakia during the crisis years using the Normalized Burn Ratio. Syrian Remote Sensing Journal 14 (2). https://www.researchgate.net/profile/Ola-Merhej/publication/343151748

[13] Shivaprasad, K M. Sowmya, M S. Danakumara, T. Gowda, M M. Kumar, R. Kumar, S D. Kumar, B S.(2025). Forest fire and its impact on forest biodiversity. Forests For Inclusive and Sustainable Economic Growth, Elsevier (2025), pp. 37-53. https://doi.org/10.1016/B978-0-443-31406-3.00004-7

[14] Rossiello MR, Szema A. Health Effects of Climate Change-induced Wildfires and Heatwaves. Cureus. 2019 May 28;11(5):e4771. doi: 10.7759/cureus.4771. PMID: 31363452; PMCID: PMC6663060.

[15] White Helmets Report.(2025). Forest fires in the Latakia countryside constitute the largest number of fires that firefighting teams across Syria have responded to.Report 8 July 2025. https://whitehelmets.org/index.php/ar/report/tqaryr-mydanyt/alhrayq-alhrajyt-fy-ryf-alladhqyt-tshkwl-aldd-alakbr-mn-alhrayq-alty-astjabt